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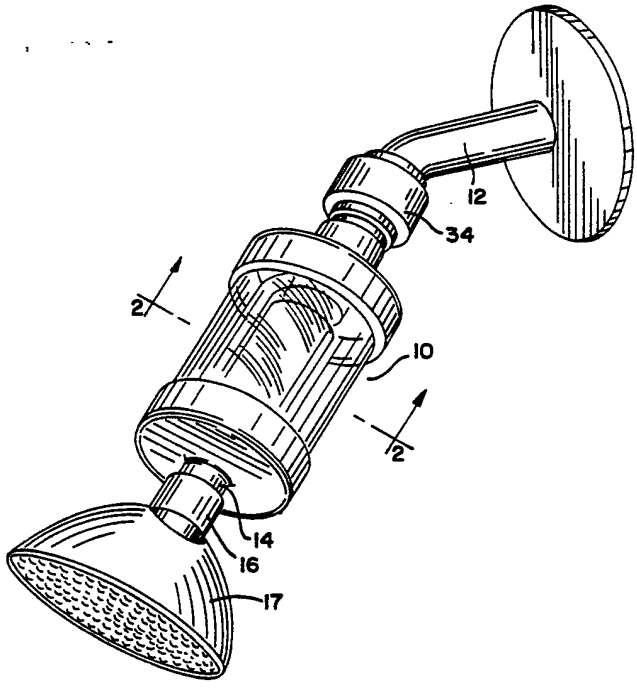

(57) Abstract

An apparatus (10) for the purification of shower water by the intimate contacting of household water with finely divided metal comprising copper, zinc or mixtures thereof. This apparatus (10) causes a circular or cyclonic flow of the water in contact with the metal. Also a method for the purification of water by the intimate contacting of household water with finely divided metal comprising copper, zinc or mixtures thereof. A showerhead (17) can be directly connected to the outlet supplying purified water by use of the following: an inlet plumbing pipe (12), an outlet plumbing pipe (14), a check valve (34) and showerhead inlet (16).

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APPARATUS AND METHOD FOR THE PURIFICATION OF SHOWER WATER

Background

The present invention relates to the purification of water. In particular, the present invention is directed to an apparatus and method for efficiently removing chlorine and other impurities from water used for showers. In this regard, an important aspect of the present invention concerns an apparatus and method for the removal of the impurities, such as chlorine, hydrogen sulfide, metals, etc. found in water used as shower water.

Apparatus and methods for the purification of water have been disclosed in the literature. The softening of water has often been the subject of disclosures on the purification of water.

Kühl U.S. Patent No. 2,216,844 discloses the use of metals which are not added to the water being treated but are added to the solution of the softening agents before their introduction into the water to be treated. According to Kühl this is an improvement on the addition of metal salts as softening agents.

Brink U.S. Patent No. 3,204,770 discloses a compact portable water softener using a zeolite. The apparatus prevents channeling of the water and provides good contact of the flowing water with a zeolite in a container.

Stephens et al U.S. Patent No. 4,242,201 discloses a by-pass water softening system which can be used in shower installations. The water softener is a change of ion exchange resin in an elongated tank.

Newlin et al U.S. Patent No. 4,332,685 discloses softening water by passing the water through an ion

exchanger and then passing part of the softened water through a reverse osmosis apparatus.

Hegde et al U.S. Patent No. 4,430,226 discloses a cartridge and method for producing ultrapure water by passing the water through an admixture of particles of mixed ion exchange resins and activated carbon low in ash content and preferably low in fines.

Also the literature contains disclosures of apparatus and method for removing other impurities from water.

Kim U.S. Patent No. 4,455,236 discloses passing waste water through a redox resin to remove hydrogen sulfide.

Nielson U.S. Patent No. 4,416,854 discloses a method and apparatus to kill microorganisms in bodies of water such as swimming pools. The disclosed apparatus is a perforated container suspendable in a body of water.

Heskett U.S. Patent No. 4,642,192 discloses removing undesirable constituents such as chlorine and nitrates from fluids by passing the fluid containing the undesirable constituents through a bed of metal particulate matter.

Then too filters useful in the removal of particles from water are well known in the art.

Collins U.S. Patent No. 1,162,455 discloses an automatically operating self-cleaning purifier or filter which permits the removal of filth, mud and other impurities from water or other liquids.

Regardless of the disclosures in the literature for the purification of water there is a need for an efficient system for the purification of water for use in showers.

Accordingly, an object of the present invention is an efficient method for the removal of contaminants in shower water.

Another object of the present invention is a system for providing purified water to a showerhead.

Another object of the present invention is an apparatus for purifying water used in shower.

Still another object of the present invention is an apparatus that can be effectively used to supply purified shower water directly to the showerhead without the need for additional equipment.

Also an object of the present invention is an apparatus that can be used continuously for extended periods of time to remove contaminants from shower water without the need to continually clean or replace its components.

Still another object of the present invention is a shower system, directly fed with purified water.

Other objects of the present invention will become apparent from the ensuing description.

Summary of the Invention

A method for the efficient removal of contaminants from shower water by circulating said water under circular flow turbulent conditions in intimate contact with finely divided metal particles comprising copper, zinc or mixtures thereof which are suspended by reason of the water flow in a chamber having water inlet and water outlet passages, means for retaining the finely divided metal particles to prevent their escape with the outlet water and sufficient space in the treating chamber to permit suspension of the particles in the treating chamber and enable the finely divided metal and water to be in intimate contact with each other. Also an apparatus for effectively removing materials that may be present in shower water such as chlorine, hydrogen sulfide, metal, etc. The present apparatus contains means for contacting said water under circular flow turbulent conditions, which can be generally described as cyclonic, with the finely divided metal and separating the finely divided metal from the outlet water. In a preferred embodiment, the purified outlet water from the present apparatus can be directly

supplied to a showerhead without the need for storage or the need for other equipment between the apparatus and the showerhead. This apparatus can find utility in uses where intimate contact of a fluid and metal particulates can be of value.

Description of the Drawings

Figure 1 is a perspective of the apparatus of the present invention connected to a plumbing pipe and a showerhead.

Figure 2 is a transverse section taken substantially along line 2-2 of Figure 1.

Figure 3 is a longitudinal section taken substantially alone line 3-3 of Figure 2.

Figure 4 is a longitudinal section taken substantially along line 3-3 of Figure 2 showing an alternative embodiment.

Figure 5 is a transverse section taken substantially along line 5-5 of Figure 4.

Detailed Description of the Invention

Referring to the drawings, there is illustrated in Figure 1 a perspective of the apparatus of the present invention 10 attached to a plumbing pipe 12, a water outlet pipe 14 and a showerhead 17. Household water flows axially through the plumbing pipe 12 into the apparatus of the present invention 10. Then the purified water will flow from the present apparatus 10 through water outlet pipe 14 and into showerhead 17 for normal use. A check valve 34 is often present in the plumbing pipe 12 in order to prevent the finely divided metal present in the chamber 28 of the apparatus 10 from entering the plumbing system which can occur when the water impact is stopped or substantially slowed, causing the pressure in the inlet line to be reduced. This shower water will have its content of chlorine, hydrogen sulfide, bacteria, heavy

metals and other contaminants substantially removed in the present apparatus.

The shower system depicted in Figure 1 is of particular value. As will be explained subsequently, the present apparatus efficiently removes from the water sent to the showerhead, contaminants which can be detrimental to the skin and other parts of the body and to the water piping. This is readily accomplished by the present apparatus which due to its convenient size made possible by its effectiveness in performance can be in the plumbing line immediately preceding the showerhead. Naturally if it is desired, the outlet line from the present apparatus to the showerhead can be sized and shaped to meet the requirements of the house.

Also the present apparatus for the purification of shower water has the unique advantage of eliminating any need to have in the line pressure equalizing equipment. The pressure at the water outlet 14 will be approximately the same as the pressure at the showerhead inlet 16, thus eliminating bulky and costly equipment that can be necessary when using reverse osmosis or other technology for the purification of the shower water. This direct connection of the water purification apparatus 10 to the showerhead 17 caused by the reasonably small size of the purification apparatus and its high efficiency in purifying water is a unique advantage of the present shower system. Furthermore, the water purified by the present apparatus having had the chlorine, hydrogen sulfide and metals removed therefrom will be significantly less likely to cause corrosion and otherwise adversely affect the plumbing pipes carrying it.

Referring now to Figures 2 and 3, one embodiment of the present apparatus can be readily described.

In the operation of this embodiment of the present household water enters the present apparatus 10 from plumbing pipe 12 by means of water inlet tubes 20 into the lower portion of chamber 28 containing finely

divided metal 29 comprising particles of copper, zinc or mixtures thereof and having unfilled space sufficient for the circular flow and intimate contact of the water and finely divided metal. The combination of copper and zinc can be an alloy. The temperature of the water will depend upon the ultimate use of the water purified by the present apparatus. Higher temperature water may be purified by the present apparatus more efficiently than lower temperature water although lower temperature can be effectively purified by the present apparatus.

The water flows from the distal end 32 of the water inlet tube 20 into the finely divided metal 29 in the lower portion of chamber 28. The water flow from the water inlet tube is by means that cause a radial flow of the suspension of water and finely divided metal. This suspension of finely divided metal in water moves in a circular fashion as best seen from Fig. 4 causing intimate contact of the finely divided metal and water. Chamber 28 in this embodiment of the present invention is maintained in position by housing 38 which is attached on opposite ends to inlet plumbing pipe 12 and outlet plumbing pipe 14. The chamber when containing the finely divided metal must have sufficient space for the cyclonic or circular flow of the water and finely divided metal. Other embodiments for holding the housing in place can be used and are within the scope of the present invention.

The finely divided metal useful in the present apparatus is preferably a mixture of metals having redox potentials such as to cause the desired oxidation and reduction reactions between the contaminants in the water and the finely divided metals. It is preferred to use finely divided metals comprising copper, zinc or mixtures thereof. Generally it is desirable to use an alloy having a weight ratio of copper to zinc from about 1:1 to about 7:3, although higher and lower weight ratios can be used effectively.

Circular or cyclonic radial flow of the water and the finely divided material comprising copper, zinc or mixtures thereof in the chamber 28 causes intimate contacting of the water and finely divided metal maximizing removal of contaminants from the water. The present apparatus also causes an unusually high amount of turbulence of the dispersion of metal in the water. A major factor in the advantages of the present apparatus is the positioning and shape of the water inlet tube 20 and its outlet 32 into the chamber 28.

As can be seen in Figure 2, one embodiment that will cause the desired circular flow and intimate contacting of the finely divided particles with the water and removal of the contaminants is the presence in the water inlet pipe's opening 32 of an elbow 24 or other directional piece of pipe that will direct the flow of inlet water towards the wall of the chamber 28. This flow as shown in Figures 4 and 5 is such that the water and the dispersed finely divided metal will circulate in chamber 28 until the purified water leaves by means of outlet water pipe 26 and through screen 35. Thus the water is in contact with the finely divided particles 29 to maximize the removal of contaminants from the water. For this reason, as previously indicated, the size of chamber 28 can be minimized. Chambers having an internal radius of 3 to 5 inches and a length of 5 to 8 inches meet most needs, although smaller or larger size chambers can be used.

Various alternatives can be used to obtain the desired flow e.g., the distal end of the opening can be slit so as to cause the water to enter the chamber in a spray. In all instances, the flow of the water and finely divided metal is radial towards the wall of the chamber.

Referring to Figures 4 and 5, the water circulation in the present apparatus can be seen. Water from the plumbing pipe 12 enters the water inlet tube 20. Check valve 34 consists of a ball 40, spring 42 and disc 44 opens to allow entry of the inlet flow of water and

closes when the water flow is turned off to prevent the finely divided material from flowing back into the plumbing pipe.

The inlet water as shown in the embodiment of the present invention shown in Figures 4 and 5 can be radially directed by the horseshoe type piece 24 or by other means such as by slitting the opening of the water inlet tube to form a spray against the wall of the chamber 28 and causing the water to flow in the circular direction depicted by the arrows. During this flow through the chamber 28 the water is in intimate contact with the finely divided metal particles 29. Then the purified water passes out of the chamber 28 by flowing through screen 35 into outlet water pipe 26. This water can then flow into a showerhead as shown in Figure 1 or be used for other purposes.

It is desired to keep the finely divided metal 29 from leaving the chamber 28 with the purified water. In this embodiment a screen having openings sufficiently smaller than the size of the metal particles was used to keep the metal particles in the chamber. By finely divided it is meant particles that are of a mesh sufficient to permit the particles to be dispersed in the turbulent water. For example, it has been found that metal particles having a mesh size of from about 50 to 400 can be used, although this invention is not limited to their use. A screen of 500 mesh will retain this size metal particles in the chamber. Other sizes and other methods of preventing the metal particles from leaving the chamber 29 with the purified water can be used for this function.

An effective amount of the metal particles are present in the chamber 28 of the apparatus. The quantity of the metal particles that can be present in the chamber and in contact with the water can vary significantly provided there is an effective amount and sufficient open space in the chamber for the circulation of the water in

contact with the suspended metal particles. Thus in most instances a small amount of the metal particles will be effective.

Other embodiments can be used within the scope of the present invention. Various means for forcing the water out of the inlet water tube 20 can be used. Although it is desired to have a smaller diameter inlet 32 than the diameter of the inlet tube 20 which can be achieved by various procedures such as having the inlet tube crimped near its open end 32 and placed in close proximity to the wall of chamber 28. By this design a spray of water enters the chamber 28 and the circulation of water and finely divided metal is sufficient to cause their intimate contact.

Other designs that allow for the water from the water inlet tube to form circular or cyclonic flow of water and finely divided metal in the chamber 28 are also within the scope of the present invention.

In experimental use the present apparatus has been effective in purifying more than 26,000 gallons of water containing 2 parts per million of chlorine. After 13,000 gallons of water had been passed through the finely divided copper and zinc particles as previously described, the chlorine content of the outlet water was about 0.0167 parts per millions; after 20,000 gallons of water had been passed through the apparatus, the chlorine contact of the outlet water was about 0.0835 parts per million; and after 26,000 gallons of water were passed through the apparatus, the chlorine content of the outlet water was 0.167 parts per million. This data demonstrates the effectiveness of the present apparatus.

It should be understood that the embodiments of the present invention which have been described are merely illustrative of a few of the applications of the principles of the present invention. Numerous modifications may be made by those skilled in the art

without departing from the true spirit and scope of the invention.

Claims

1. An apparatus for the purification of household water which comprises:

a chamber having water inlet and outlet passages, containing an effective amount of a finely divided metal having a suitable redox potential and having sufficient unfilled space for the suspension of the finely divided metal in the household water flowing therethrough;

water inlet means for directing the flow of household water into and radially outwardly through the finely divided metal in the chamber and for suspending the finely divided metal particles in said chamber; and

means for separating said finely divided metal from the outlet water leaving the chamber through the outlet passage.

2. The apparatus of claim 1 wherein the water inlet means comprises a tube attached at one end of the source of the household water and having its distal end smaller than the diameter of the body of the tube.

3. The apparatus of claim 1 wherein the distal end of the household water inlet is slit so that the water enters the chamber in the form of a spray

4. The apparatus of claim 2 wherein the distal end of the household water inlet directs the inlet water towards the wall of the chamber so as to cause a circular flow of the water and finely divided metal.

5. The apparatus of claim 4 wherein the household water inlet is positioned in proximity of the wall of the chamber.

6. The apparatus of claim 1 wherein the outlet water passage connects to a showerhead.

7. The apparatus of claim 1 wherein the means for removing the finely divided metal from the outlet water is a screen having openings smaller than the diameter of the finely divided metal.

8. The apparatus of claim 1 wherein a check valve is positioned with the household water inlet tube to prevent the finely divided metal from discharging from the chamber into the source of the household water.

9. The apparatus of claim 1 wherein the finely divided metal comprises copper, zinc or mixtures thereof.

10. The apparatus of claim 9 wherein the finely divided metal comprises a weight ratio of copper:zinc between about 1:1 and about 7:3.

11. A method for the purification of water which comprises passing water though finely divided metal comprises copper, zinc or mixtures thereof contained in a chamber; subjecting the water and finely divided metal to a circular turbulent intimate contacting and removing the purified water from the chamber substantially free of the finely divided metal.

12. The method of claim 11 wherein the weight ratio of copper to zinc is from about 1:1 to about 7:3.

13. The method of claim 12 wherein the purified water leaves the chamber at a rate sufficient to cause effective operation of a showerhead.

14. A shower system using purified water comprising an apparatus for purifying water by contacting water under circular flow turbulent conditions with finely divided metal comprising copper, zinc or mixtures thereof and a showerhead directly receiving said purified water.

15. An apparatus for the purification of household water which comprises:

a treating chamber having water inlet and outlet passages,

said chamber including a treating section containing an effective amount of finely divided metal particles having a suitable redox potential for effecting treatment of water passing therethrough to remove impurities contained in said water, said treating section having a generally annular configuration,

said inlet passage communicating with an inlet feed distributor through which water to be treated travels axially through said chamber and is said radially outwardly discharged in the direction of an interior wall of said chamber and then radially inwardly through said annular treating section,

said outlet passage communicating with a central core in said annular treating section of said chamber, which core is defined by an inner cylindrical wall, and said inner cylindrical wall including means for retaining said finely divided particles in said treating section and permitting the flow of treated water therethrough.

16. The apparatus of claim 15 wherein said inlet feed distribution includes flow restriction means for increasing the velocity of water which is radially outwardly discharged therefrom.

17. The apparatus of claim 15 wherein the amount of finely divided particles in said treating section of said chamber is such that said particles will be suspended therein when water is passing radially inwardly therethrough.

18. The apparatus of claim 15 wherein said inlet distributor and interior wall of said chamber cooperate to impart a radially inward and circular flow of water through the annular treating section of said chamber.

FIG. 1

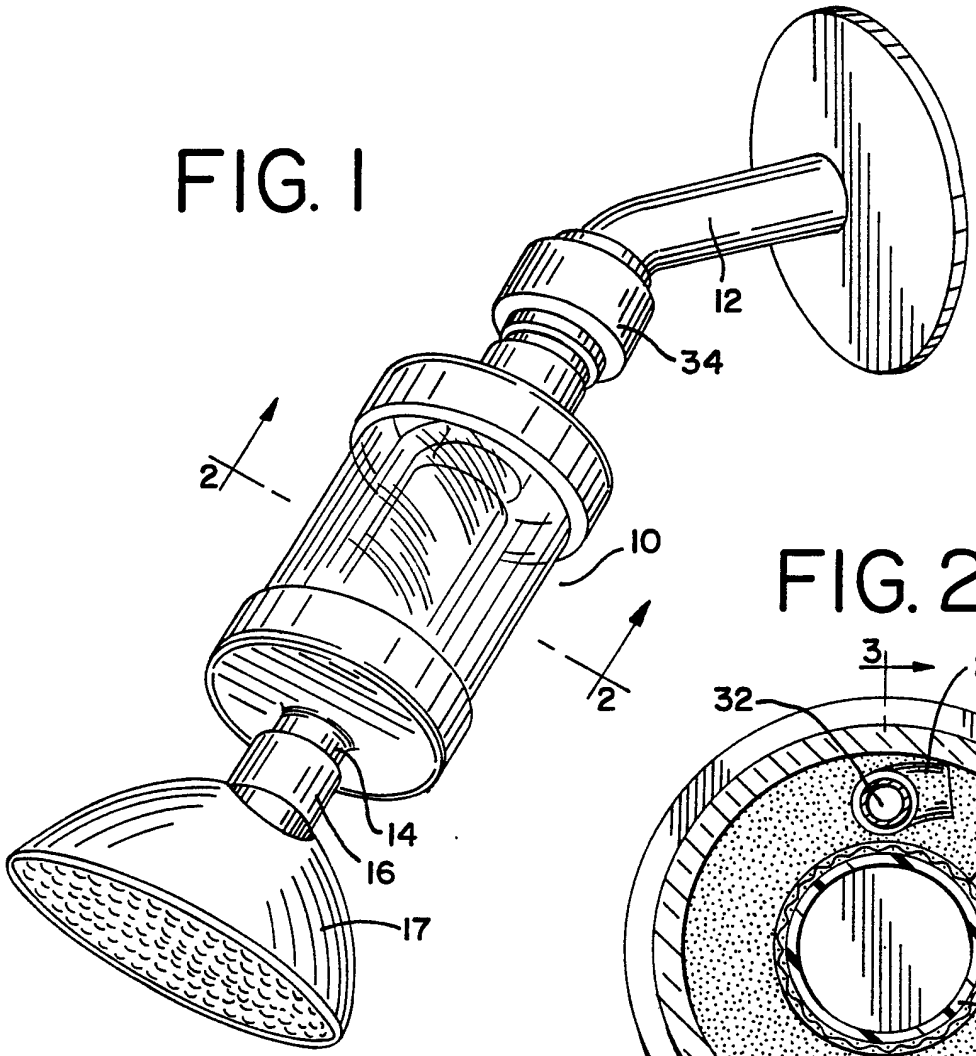


FIG. 2

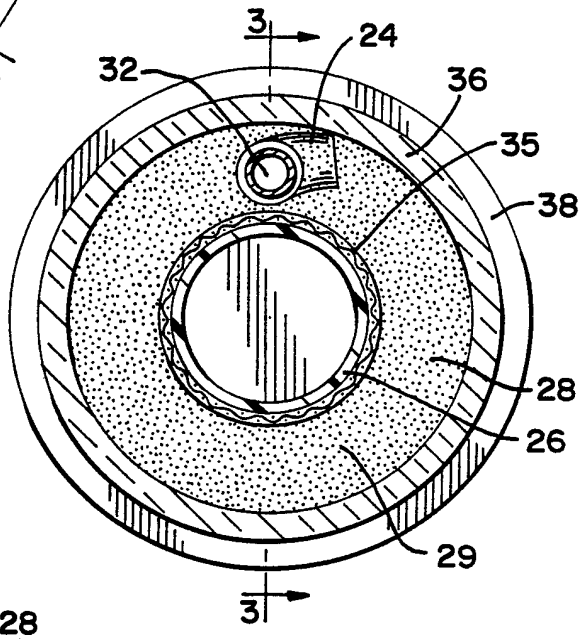


FIG. 3

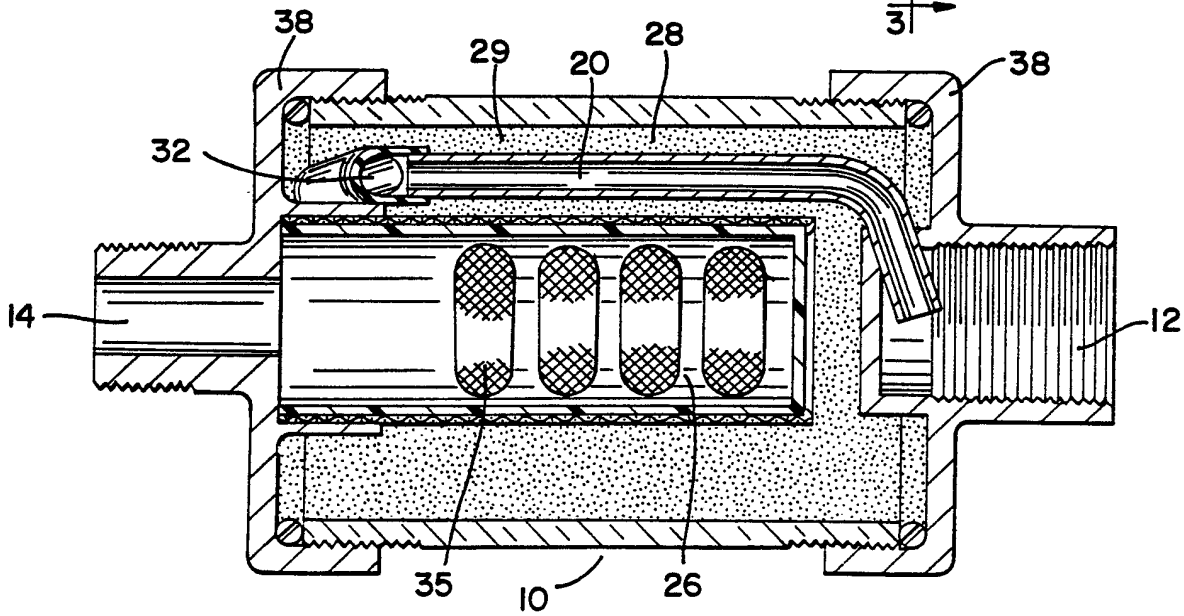


FIG. 4

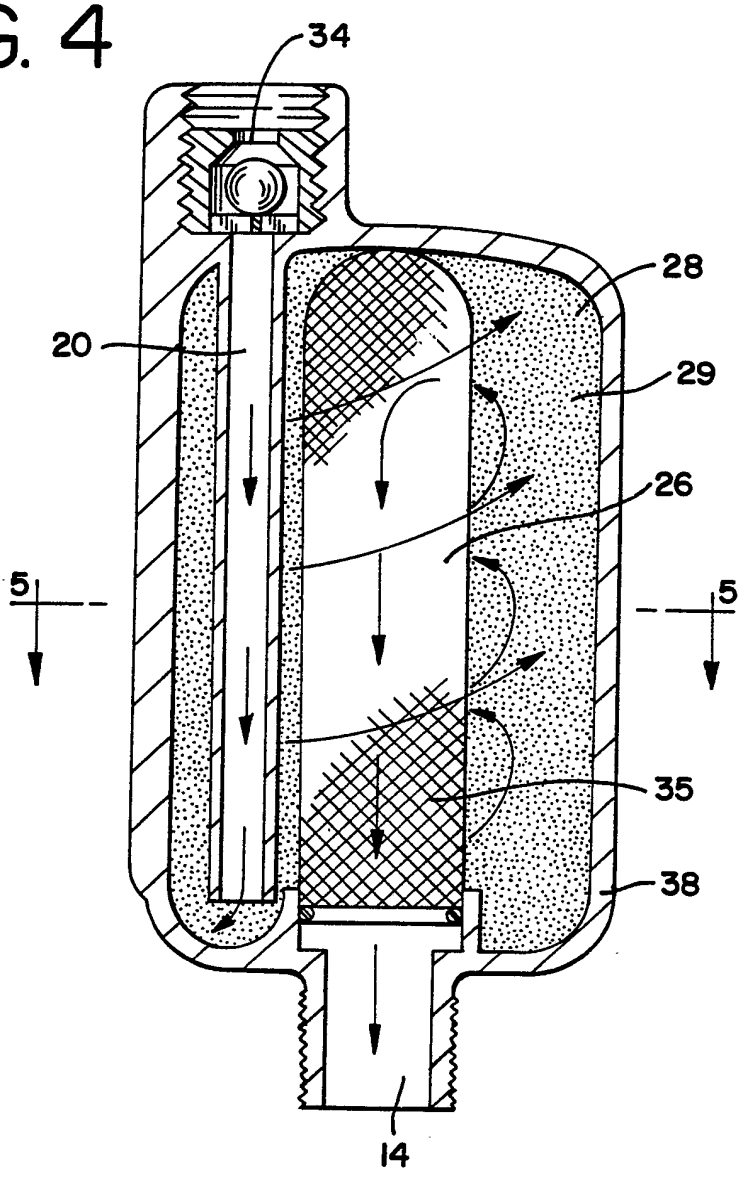
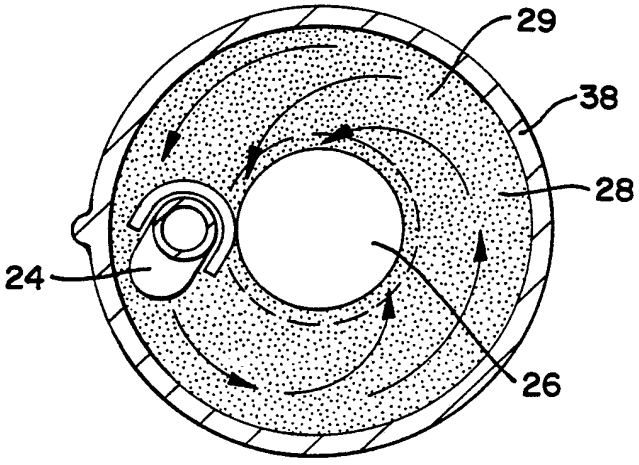


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :C02F 1/70 B01D 39/20
US CL :210/757, 764, 198.1, 266, 282, 449, 460, 500.25, 503
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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U.S. : 210/696, 500.1, 263, 508, 505, 459

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US, A, 5,008,011 (UNDERWOOD) 16 APRIL 1991 (see fig. 2, col. 2, lines 55-65)	1-2, 4-9, 11, 14 3,10,12,13,15-18
A	US, A, 5,013,450 (GOMEZ) 07 MAY 1991 (see entire document)	
A	US, A, 4,933,080 (RUNDZAITIS ET AL.) 12 JUNE 1990 see entire document	
Y	US, A, 2,216,844 (KUHL) 08 OCTOBER 1940 (see col. 2, lines 21-33)	10, 12, 13
A	US, A, 4,642,192 (HESKETT) 10 FEBRUARY 1987 (see entire document)	
Y	US, A, 3,204,770 (BRINK) 07 SEPTEMBER 1965 (see col. 1, line 68 - col. 2 line 35; fig. 1)	15-18

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